In evaluating K_C, account is also taken of the energy spectrum of the shower-producing particles. This results in an additional reduction in the value of K_C.

The problem is considered of evaluating the energy transferred to the generated mesons and the effect produced by the fraction of heavy mesons in on the magnitude of this energy. The energy of the primary particle has been correlated with the energy transferred, on the magnitude of this energy. The energy of the primary particle has been correlated with the energy transferred, on the average, to the generated mesons.

Reprot presented at the International Cosmic Ray Conference, Moscow, 6-11 July 1959.

TAKIBAYEV, Zh. S.

AN ANALYSIS OF THE ANGULAR DISTRIBUTION OF THIN TRACKS OF SHOWERS PRODUCED BY $\geq 10^{11}$ ev PARTICLES

Zh. S. Takibayev, A. A. Loktionov, L. A. Sanko,
Ts. I. Shakhova

An analysis is made of the angular distribution of thin tracks of showers produced by cosmic-ray particles with energy exceeding 10^{11} ev. To determine the energy dependence of the angular distribution of the shower-producing particles, all analyzed showers are divided into two energy intervals. The first interval includes all showers produced by particles (protons, neutrons, pi-mesons) with energy of the order of 10^{11} ev (at least $>10^{10}$ ev): the second interval includes particles with energy exceeding 10^{12} ev. For comparison a study is made of showers taken from published material.

The experimental data obtained are compared with the model of "two centres" that independently emit mesons (Takagi, Feinberg and Chernavsky, Kokkoni et al.). The comparison reveals the limitations of this model. The observed angular distribution of thin tracks of a number of showers may be explained on the assumption that:

a) there is a power energy spectrum in the centre-of-mas system ($\sim AdE/E^{\gamma+1}$), which agrees with the Heisenberg theory:

1) there is a sharply anisotropic angular distribution in the centre-of-mass system ($\sim \cos^2 \Theta$), although such a high degree of anisotropy of generated particles does not follow from the Heisenberg theory.

Report presented at the International Cosmic Ray Conference, Moscow, 6-11 July 1959.

21(7)

AUTHORS: San'ko, L. A., Takibayev, Zh. S., Shakhova, Ts. I., Balats, L. Ya.

SOV/56-37-1-1/64

TITLE: On the Angular Distribution of Shower Particles in Stars Formed by Particles of High Energy (Ob uglovom raspredelenii livnevykh chastits v zvezdakh, obrazovannykh chastitsami bol'shoy energii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 1, pp 3-10 (USSR)

ABSTRACT: In the course of the evaluation of emulsion piles exposed in the geographical latitude of Moscow at a height of 30 km, a star (20 + 15 + 59p) was recorded, which had been produced by an interaction between a cosmic radiation proton and an emulsion nucleus (Fig 1). In the present paper the authors report about an analysis of the angular distribution of charged particles in this star. The energy of the primary particle was determined as amounting to $E = (19\ ^{+50.7}_{-14.0}) \cdot 10^3$ Bev. According to Heitler and Terreaux (Ref 4) the star ought, at such high energies, to consist only of 3-4 highly ionizing particles; the star investigated by

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the authors (N_h = 35) cannot be explained by the Heitler-Terreaux theory. Figure 2 shows the differential angular distribution of the shower particles in this star. The histogram has two different maxima. For comparison, the curves for isotropic distribution (in the cms), for Heisenberg distribution, and for distribution according to Landau are plotted. It was found that, if it is assumed that in a nucleon-nucleus collision the angular distribution does not deviate considerably from that of the mesons formed in a nucleon-nucleon collision, the angular distribution observed can be explained neither by Heisenberg's (Ref 6) nor by Landau's theory (Ref 7). Figure 3 again shows a histogram of the angular distribution of shower particles in the laboratory system. The curves 1,2,3,4 (in the cms) successively show Gaussian, isotropic, and anisotropic distribution for each of the two maxima separately (in consideration of the energy spectrum of the produced particles and on the assumption that they are monoenergetic). It may be assumed that the two maxima observed in the differential angular distribution originate from a meson

emission of two unconnected centers, which move in different directions in the cms: 30 particles in the narrow and 29 in the diffuse cone. Figure 4 shows the integral angular distribution of such a star. The authors then give a report on an investigation of further 11 stars with $E_{prim} > 100$ Bev, which have the same characteristic anisotropy. Figure 5 shows the total histogram of these 11 showers with the two maxima. Table 2 shows the results of an analysis of all investigated showers (Nr 10 gives the data of the first star described in detail). In conclusion, the angular distribution of the gray and black traces of the (35 + 59p) star is discussed on the basis of figure 6. There are 6 figures, 2 tables, and 12 references, 8 of which are Soviet.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences, Kazakhskaya SSR)

SUBMITTED: November 14, 1958

24(5),21(7) SOV/56-37-1-43/64

AUTHORS: Boos, E. G., Takibayev, Zh. S.

TITLE: On an Evaluation of the Energy Characteristics of Shower-producing Particles (Ob otsenke energeticheskikh kharakteristik livnegeneriruyushchikh chastits)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fizki, 1959, Vol 37, Nr 1, pp 292-293 (USSR)

ABSTRACT: It has already been shown experimentally that for the particle momenta $p_\perp$ (in units μc, where μ denotes the particle mass) in cosmic showers it holds that: $p_\perp \approx 1$, where the individual values no longer deviate from the average value. This fact, as well as the assumption concerning the symmetric flying-apart of the shower particles in the cms, permits an evaluation of the parameter $\gamma_c = 1/\sqrt{1-\beta_c^2}$, where β_c is the velocity of the cms with respect to the laboratory system. The authors of the present "Letter to the Editor" investigate two variants of the symmetric flying-apart: a) the angular symmetry for particles departing under the angles θ_i' and θ_j', if $\theta_j' = \pi - \theta_i'$, and b) if on both sides of a plane that is perpendicular to the direction of the motion of the cms the same number of

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On the Evaluation of the Energy Characteristics of Shower-producing Particles

SOV/56-37-1-43/64

particles is found. A table shows the numerical results of theoretical considerations for a number of showers (the experimental data were obtained from references 4-8); the values for γ_c and K for the variants a) and b) at various conditions are given and are briefly discussed in the following. It was found that, under the assumption $p_1 \approx 1$, an evaluation of the energy characteristic (γ_c and K) in showers, of which only the angular distribution of the secondary particles is known, is possible. The thus obtained γ_c-values agree well with those which have been obtained on the assumption of an exponential energy spectrum of the produced mesons (Ref 7). There are 1 table and 9 references, 4 of which are Soviet.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences, Kazakhskaya SSR)

SUBMITTED: January 15, 1959

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The dependence of the Emission-Frequency of Shower Particles on the Atomic Number of the Split Nucleus.

which are to be determined in the stars with $n_s \leq 6$) can be explained by the aid of the multiple-multiple theory of production. At least up to an energy of 10 BeV the production probability of pions in tungsten is greater than in aluminum. According to data obtained on a cosmotron and a betatron at energies of from 1 to 6 BeV multiplicity hardly depends at all on the atomic number of the target nucleus. The author further investigated several other problems and obtained among others the following results: The energy spectra of the recoil nucleons created on the occasion of the spallation of tungsten-and aluminum nuclei differ essentially from one another. "Transparency" (in the sense of the production of stars with $n_h \geq 3$) of aluminum and copper decreases from 600 to 3000 MeV with an increase of the energy of the shower-forming particles. The number of emitted fast protons with energies of from 30 to 300 MeV increases with an increase of the atomic number of the disintegrated nucleus and also with an increase of the energy of the star-producing particles.(1 illustration, 1 table).

ASSOCIATION Physical-Technical Institute of the Acad. of Science of the Kazakhian SSR
PRESENTED BY Skobeltsyn, D.V., Member of the Academy.
SUBMITTED 4.6.1956.
AVAILABLE Library of Congress.
Card 2/2

21 (1), 21 (7)

AUTHOR: Takibayev, Zh., Academician, AS KazakhSSR SOV/20-127-1-17/

TITLE: On the Rôle of Antinucleons and Mesons in Secondary Interactions at High Energy Levels (O roli antinuklonov i mezonov vo vtorichnykh vzaimodeystviyakh v oblasti vysokikh energiy)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 127, Nr 1, pp 67 - 69 (USSR)

ABSTRACT: An investigation of the angular distribution of thin traces in the showers recorded in photographic emulsions furnishes the basis for the high degree of excitation of the colliding nucleons, each of which separately emits pions. Such a hypothesis was brought forward by several authors (Ref 1). Further experimental investigations, however, showed that the coefficient of nonelasticity (i.e. the fraction of energy transmitted to the produced particles) in most cases is of the order of magnitude 0,15 to 0,20, which cannot be explained by the model of two centers of meson emission formed by the nucleons. Further objections against the two-center model are made. According to the author's opinion, the character of the observed angular distributions in the laboratory system may be explained by tak-

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ing the antinucleons and mesons produced in the primary act of collision into account. As an example, the angular distribution of the thin traces of a shower 35 + 59p is analyzed. The angular distribution $dN/d[\ln \operatorname{tg} \theta]$ of the shower particles is characterized by 2 maxima and cannot be explained by peripheral collisions, because a large number of peripheral collisions between the arriving nucleon and the nucleons of the nucleus in the "tube" is only very little probable. From the hydrodynamic theory the existence of two maxima does not follow. The author assumes that, as the result of a collision between the arriving nucleon and one of the nucleons (or with a group of nucleons probably forming a uniform and compact medium) of the target nucleus, about 30 charged particles are produced. Most of them are pions. However, among the particles thus produced there may be a certain fraction of strange particles and antinucleons. The particles produced during the first act of the collision move, within a narrow angle, nearly in the same direction, and may, in turn, produce about 30 charged particles in the course of several collisions. The energy of the arriving particles is then determined by the position of the left

maximum of the angular distribution shown by an attached figure. The position of the second (right) maximum determines the average value of the energy of the secondary particles. Formulas are written down for the differential and integral angular distribution. In a diagram the curve given by the integral angular distribution is compared with the distribution of the shower particles of the star 35 + 59 p. Agreement is fully satisfactory. Such comparisons are, by the way, possible for any stars. The production of the shower particles may thus be explained as follows: 1) In the case of high multiplicity the angular distribution of particles (produced in the first stage of the collision between the particle and any part of the target-nucleus) is nearly isotropic in the center of mass system. 2) The angular distribution is subject to considerable fluctuations. 3) The angular distribution $\Delta N/\Delta x$, which was observed in the laboratory system, may correspond to an anisotropic distribution in the center of mass system, but this apparent superposition is - roughly speaking - only due to the superposition of two types of collisions. 4) The analysis of the angular distribution of all "two-hump" showers on the basis of the

On the Rôle of Antinucleons and Mesons in Secondary Interactions at High Energy Levels

SOV/20-127-1-17/65

here discussed uniform point of view does not contradict the experimental data. There are 2 figures and 3 references, 2 of which are Soviet.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk KazSSR (Institute of Nuclear Physics of the Academy of Sciences, KazakhSSR)

SUBMITTED: April 27, 1959

Card 4/4

21 (0)
AUTHOR: Takibayev, Zh. S., Academician of the AS KazakhSSR

SOV/30-59-5-24/43

TITLE: Investigations of the Kazakhstan Scientists on Cosmic Rays (Raboty uchenykh Kazakhstana po kosmicheskim lucham)

PERIODICAL: Vestnik Akademii nauk SSSR, 1959, Nr 5, pp 101-104 (

ABSTRACT: The scientists' efforts in the field of the physics of cosmic rays were directed from the beginning onto the investigation of nuclear phenomena caused by high-energy particles. The method of nuclear photoemulsions was applied for this purpose. Since 1950, the stratosphere has been explored at altitudes of from 25 to 30 km, attention being chiefly devoted to the investigation of nuclear fission showers that are accompanied by the formation of a large quantity of π-mesons and other elementary particles (see Fig 1). In dependence of the character of the collision of particles, distributions occurring may belong to type 1 or to type 2 (see Fig 2). S. Takagi assumed the presence of two emission centers of π-mesons in the center-of-mass system of colliding nucleons. This assumption, however, has not proved to be correct, and further thorough investigations are therefore required.

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Investigations of the Kazakhstan Scientists on Cosmic Rays

SOV/[illegible]

The Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences of the Kazakh SSR) began investigations on the direct energy determination of primary particles with the method which is now being developed in the MGU/Moskovskiy gosudarstvennyy universitet (Moscow State University). At present, efforts are particularly devoted to the determination of the role played by the unsteady particles in the formation of showers. In conclusion, the hope is expressed that it may be possible also in the future to work in close contact with the scientists working on the same problems at the Fizicheskiy institut im. P. N. Lebedeva (Physics Institute imeni P. N. Lebedev), Institut atomnoy energii Akademii nauk SSSR (Institute of Atomic Energy of the AS USSR), the Moscow University, and other scientific centers, in which cosmic rays are under investigation. There are 2 figures.

Card 2/2

SATPAYEV, K.I., glavnyy red.; CHOKIN, Sh.Ch., otv.red.; BAZANOVA, N.U., red.; BEKTUROV, A.B., red.; POKROVSKIY, S.N., red.; POLOSUKHIN, A.P., red.; TAKIBAYEV, Zh.S., red.; ASAINOV, M.A., red.; POGOZHEV, A.S., red.; SEMENOV, M.N., red.; PROKHOROV, V.P., tekhn.red.

[Science in Soviet Kazakhstan, 1920-1960] Nauka Sovetskogo Kazakhstana, 1920-1960. Alma-Ata, 1960. 688 p.
(MIRA 13:12)

1. Akademiya nauk Kazakhskoy SSR, Alma-Ata.
(Kazakhstan--Science)

S/707/60/003/000/003/013
B117/B102

AUTHORS: Boos, E. G., Takibayev, Zh. S.

TITLE: A survey of methods for estimating the energy and the inelasticity coefficient in meson showers produced by cosmic rays

SOURCE: Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy. v. 3, 1960. Vzaimodeystviye vysokoenergichnykh chastits s atomnymi yadrami, 46-63

TEXT: This survey analyzes various recent methods for estimating the energy of shower-producing particles, which are based on angular distribution measurements of secondary particles. L. D. Landau, A. I. Nikishov, and I. L. Rozental' are mentioned. There are 4 figures, 3 tables, and 35 references: 16 Soviet-bloc and 19 non-Soviet-bloc. The four references to English-language publications read as follows: B. Edwards, J. Losty, D. H. Perkins, K. Pinkau, and I. Reinholds, Phil. Mag. 3, 237, 1958; C. Powell, Report delivered at the Geneva Conference on the Peaceful Use of Atomic Energy, Geneva, 1958; Camerini, Fowler P. H. et al.

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S/707/60/003/000/003/013
B117/B102

A survey of methods for ...

Phil. Mag. 41, 413, 1950; V. D. Hupper et al. Phys. Rev. 84, 457, 1951.

Card 2/2

S/058/61/000/010/011/100
A001/A101

3.1410

AUTHORS: Boos, E.G., Takibayev, Zh.S.

TITLE: Estimate of the energy ($E > 5 \times 10^{10}$ ev) of primary particles from angular and energy distributions of secondary shower particles

PERIODICAL: Referativnyy zhurnal. Fizika, no.10, 1961, 95, abstract 10B492 ("Tr. Mezhdunar. konferentsii po kosmich. lucham, 1959, v. 1", Moscow, AN SSSR, 1960, 76 - 86)

TEXT: The Lorentz-factor γ_c, mean energy $\overline{\varepsilon'}$ of the produced particles and fraction of energy K conveyed to these particles in the center-of-mass system are estimated by the method based on using transverse momentum of shower particles. A correlation between quantities K, $\overline{\varepsilon'}$, n_s and γ_c is studied within the framework of this method. The energy spectrum of the shower-producing component is taken into account in estimating the value of γ_c. It is shown that in all theories and models of multiple meson production discussed in the present article, in which primary nucleons are not separated from the emitting volumes, the form of K-γ_c relation does not correspond to that observed in experiments.

[Abstracter's note: Complete translation]

L. Dorman

Card 1/1

3/058/61/000/010/010/100
A001/A101

3.2410

AUTHORS: Vinitskiy, A.Kh., Golyak, I.G., Takibayev, Zh.S., Chasnikov, I.Ya.

TITLE: Investigation of energy spectrum of particles produced in high-energy nuclear interactions

PERIODICAL: Referativnyy zhurnal.Fizika, no.10, 1961, 95, abstract 10B491 ("Tr. Mezhdunar. konferentsii po kosmich lucham, 1959, v. 1", Moscow, AN SSSR, 1960, 61 - 70)

TEXT: The authors investigated showers in which the energy of produced particles was determined by measuring multiple Coulomb scattering or, in rare cases, by measuring relative scattering of closely flowing particles. In the case of two showers (2 + 16 p and 2 + 14 n), the spectra of γ-quanta, being decay products of π^0-mesons, were obtained; the energies of γ-quanta were determined on the basis of analysis of electron-positron pairs produced by them. The experimental data obtained in this way are compared with spectra of γ-quanta following from various versions of the theory of multiple meson production.

L. Dorman

[Abstracter's note: Complete translation]

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S/707/60/003/000/005/013
B125/B102

24670

AUTHORS: Boos, E. G., Takibayev, Zh. S.

TITLE: Transverse momentum distribution of mesons in high-energy showers

SOURCE: Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy. v. 3, 1960. Vzaimodeystviye vysokoenergichnykh chastits s atomnymi yadrami, 89-99

TEXT: The present paper gives a systematic classification of the transverse momenta following from various theories of multiple meson production at high energies and from various phenomenological schemes. According to the hydrodynamic theory of L. D. Landau (Izv. AN SSSR, seriya fiz., 17, 51, 1953), the formulas

$$\frac{dN}{N\cdot dp_\perp} = \frac{c_2}{4c_1}\cdot\frac{\mu}{M}\cdot\frac{\exp\left[-\frac{L}{6}+\frac{2}{3}\sqrt{L^2-\lambda^2}\right](1+\exp(-2\lambda))^2}{\left[2\cdot\exp(-2\lambda)-\frac{\lambda}{3\cdot\sqrt{L^2-\lambda^2}}(1+\exp(-2\lambda))\right]}; \qquad (3),$$

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Transverse momentum distribution...

$$p_{\perp} = 2 \cdot \frac{c_1 \cdot M}{\mu} \cdot \frac{\exp\left[-\frac{L}{6} + \frac{1}{3}\sqrt{L^2 - \lambda^2}\right]}{1 + \exp(-2\lambda)}; \quad \lambda < \left|\frac{\sqrt{3}}{2} L\right|; \qquad (4)$$

and Fig. 1 hold for the meson distribution on transverse momenta. M and μ are the nucleon and pion masses respectively. The law of the conservation of momentum is satisfied neither by the Fermi theory nor by Landau's hydrodynamic theory, as practically all values of the inelasticity coefficient disagree with experimental data: The part of mesons with large transverse momenta is considerably larger than it is in reality. According to the Fermi theory, the distribution

$$\frac{dN}{N dp_{\perp}} = \frac{\gamma^3 \cdot p^2_{\perp}}{a \cdot f(\rho)} \cdot \int_{-1}^{+1} (1 - y^2)\, dy \int_{-1}^{+1} \frac{d\tau_1}{(1 - \tau_1^2)^{3/2} \cdot \left\{\exp\left[\frac{\gamma p_{\perp}}{\sqrt{1 - \tau_1^2}} \cdot (1 - \rho\tau_1 y)\right] - 1\right\}}, \qquad (7)$$

где $a = 2{,}413$ и $f(\rho) = \left[\frac{1 + \rho^2}{\rho^3} \cdot \ln\frac{1 + \rho}{1 - \rho} - \frac{2}{\rho^2}\right]$.

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shown in Fig. 2 for γ_c = 10 and for various values of the inelasticity coefficient, is found at high energies and not as predicted (3) and (4). The Fermi theory (taking into account the conservation of momentum) and the Landau theory give correctly the anisotropy of the angular distribution of mesons produced in high-energy nucleon-nucleon collisions. But both theories probably give a much too hard energy distribution of the mesons produced and hence incorrect transverse momentum distributions. With the Bose distribution of pions, a transverse momentum distribution is obtained which depends on the critical temperature (T_{crit} at which the system begins to disintegrate). On the condition of monoenergetic mesons in the center of mass system, the distribution

$$\frac{dN}{Ndp_\perp} = (2\cdot n+1)\cdot\left(1-\frac{p_\perp^2}{p_0^2}\right)^{n-\frac{1}{2}}\cdot\frac{p_\perp}{p_0^2};\ 0\leqslant p_\perp\leqslant p_0, \qquad (11)$$

holds, where p_o is the momentum of mesons in the center of mass system.

For a Heisenberg spectrum

$$\frac{dN}{N \cdot dp_\perp} = \frac{p_\perp^2 \cdot I_n(\beta)}{(p_\perp^2+1)^2} \Big/ \int_0^\infty \frac{p_\perp^2}{(p_\perp^2+1)^2} \cdot I_n(\beta) \cdot dp_\perp. \qquad (14)$$

holds in the case of anisotropic angular distribution. The experimental data can by no means be accounted for by monoenergetic or isotropic meson distributions ($n = 0$) in the center of mass system. Heisenberg's ideas on the magnitude of transverse momenta are confirmed experimentally. In the case of $n > 10$, the angular anisotropy is too sharp and does not correspond to the experimental distribution. There are 6 figures, 1 table, and 27 references: 10 Soviet and 17 non-Soviet. The two references to English-language publications read as follows: V. D. Hopper, S. Biswas, J. E. Darby, Phys. Rev., 84, 457, 1957; B. Edwards, F. Losty, D. H. Perkins, K. Pinkau, and P. Reynolds, Phil. Mag. 3, 237, 1958.

S/707/60/003/000/006/013
B125/B103

AUTHORS: Takibayev, Zh. S., Vinitskiy, A. Kh., Zaytsev, K. G.

TITLE: Analysis of high-energy nuclear interaction

SOURCE: Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy. v. 3, 1960. Vzaimodeystviye vysokoenergichnykh chastits s atomnymi yadrami, 100-105

TEXT: The present paper describes a cosmic-ray shower at an altitude of 30 to 33 km found during a 90 hours' exposure in a stack of 40 films of type P (R) and consisting of 61 minimally ionized tracks. It passed through 36 emulsion films and an aluminum sheet 0.5 mm thick. The charged shower particles produced at primary interaction form nine secondary interactions. The distance R between the stack and the point of intersection of all tracks with the original track was determined from the deviation of all secondary tracks relative to the primary track, measured in the first plate. Most tracks correspond to a distance of 20 to 30 mm. $R = 25 \pm 5$ mm, if all originate from charged particles produced in the primary collision. Using the formula

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Analysis of high-energy nuclear...

$$-\ln \gamma_c = (1/n_s) \sum_{i=1}^{n_s} \ln \tan \theta_i \qquad (1),$$

the energy γ_c of the incident nucleon in the center of mass system was determined (in terms of the rest mass) from the angular distribution of shower particles produced at secondary interaction. θ_i is the angle enclosed by the trajectory of the i-th particle and the shower axis in the laboratory system. The primary particle energy determined by different methods and under different conditions is: i) $\gamma_c = 324$ and $E = 1.07 \cdot 10^5$ and $\gamma_c = 202$ and $E = 0.76 \cdot 10^5$ Bev, respectively, when calculated according to (1) and if 26 and 38 particles are emitted in the first collision. According to (1) $\gamma_c = 440$; $E = 3.7 \cdot 10^5$ Bev and $\gamma_c = 296$; $E = 1.7 \cdot 10^5$ Bev, respectively when using 61 and 73 tracks passing through the first plate. The values of γ_c and of the inelasticity coefficients K were calculated for 26 particles from the angular distribu-

tion by a method developed by the authors. At constant transverse momentum $P_\perp$ they were found to be: at P = 1 μc; 2 μc and 3 μc, γ_c = 234, 296 and 316, respectively, and K = 0.019; 0.034 and 0.043, respectively, and for π^0 particles at $P_\perp$ = 1 μc; 2 μc and 3 μc γ_c = 186; 239 and 254, respectively, and K = 0.054; 0.085 and 0.119, respectively. The values $\epsilon_c \sim 10^{14}$ ev and K = 0.10-0.02 found by the method of H. Huzita (Nuovo Cimento, 4, 641, 1957) agree with results obtained by B. Edvards et al., (Phil. Mag. 3, 237, 1958). The angular distribution found in the first plate by the method of coordinates shows a better coincidence with the anisotropic Heisenberg distribution than with the monoenergetic isotropic distribution. The angular distribution of particles produced at secondary interaction is isotropic at average energies of ~5 Bev, already less isotropic at ~40 Bev and agrees better at some hundred Bev with anisotropic distribution. There are 6 figures, 1 table, and 6 references: 2 Soviet and 4 non-Soviet. The two references to English-language publications read as follows: Gastagnoli, G. Cortini, Franzinetti, A. Manfredini and D. Moreno, Nuovo Cimento, 10, 1539, 1953; B. Edvards.

Analysis of high-energy nuclear... S/707/60/003/000/006/013
B125/B102

J. Losty, D. H. Perkins, K. Pinkau and J. Reynalds, Philosophical Magazine, 3, 237, 1958.

Card 4/4

85334

S/120/60/000/005/002/051
E032/E514

24.6810
AUTHORS: Chasnikov, I.Ya., Takibayev, Zh.S., Tursunov, R.A. and Sharapov, K.V.

TITLE: Measurement of Multiple Scattering on the Tracks of ~10 GeV Protons

PERIODICAL: Pribory i tekhnika eksperimenta, 1960, No.5, pp.15-19

TEXT: A large number of papers have been published on the multiple scattering of charged particles in nuclear emulsions (Refs.1-10 and others) in which it is concluded that micro-distortions of the emulsion give rise to spurious scattering. These local distortions are a serious problem in high-accuracy work. Other sources of spurious scattering, such as stage noise, thermal noise etc. can now be adequately allowed for so that the local distortion is a residual effect still to be overcome. The present authors have measured the multiple scattering in НИКФИ-Р (NIKFI-R) emulsions 450 μ thick using the МБИ-8 m (MBI-8 m) microscope. The 10 GeV synchrophasotron of the Joint Institute for Nuclear Studies was used as the source of the protons. The total length of tracks examined was 2.8 m and the mean length per track was 5 cm. The

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S/120/60/000/005/002/051
E032/E514

Measurement of Multiple Scattering on the Tracks of ~10 GeV Protons

following methods were used to analyse the data obtained. The second difference $\bar{D}$ can be written down in the form

$$\bar{D}^2 = \bar{D}_k^2 + n^2 \qquad (1)$$

where $\bar{D}_k$ is the contribution due to Coulomb scattering and is equal to $1.74\ Kt^{3/2}/PV$, where P is the momentum, V is the velocity, K is the scattering constant and n is the contribution due to spurious scattering. When $\bar{D}_k \leqslant 4n$, the quantity n can be excluded by various methods, for example, by taking higher differences (Ref.10). The spurious scattering n can be looked upon as consisting of two parts, one of which depends on the cell size and the other does not. The latter can always be subtracted from the measured $\bar{D}$ in which case Eq.(1) can be re-written in the form

$$\bar{D}^2 = (1.74\ K/PV)^2 t^3 + a^2 t^{2x} \qquad (2)$$

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Measurement of Multiple Scattering on the Tracks of ~ 10 GeV Protons

On the other hand, the method of three multiple cells described by Chasnikov et al. (Ref.8) gives

$$\bar{D}_K = \left(\frac{\bar{D}_1^2 \bar{D}_4^2 - \bar{D}_2^4}{64\bar{D}_1^2 + \bar{D}_4^2 - 16\bar{D}_2^2} \right)^{1/2} \qquad (3)$$

where $\bar{D}_1$, $\bar{D}_2$ and $\bar{D}_4$ are the mean second differences for cells in the ratio 1:2:4. If one takes into account the fact that the scattering constant K depends on the cell size, the numbers 64 and 16 in Eq.(3) should be replaced by 68 and 16.48. The spurious scattering n can be independently determined and excluded by using higher differences, for example, third, fourth etc. differences. The higher differences also exclude systematic distortions. Chasnikov (Ref.10) has also shown that the dependence of the higher

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Measurement of Multiple Scattering on the Tracks of ~ 10 GeV Protons

differences on $\bar{D}_K$ and n is

$$n = 0.5222(2\bar{D}^{III^2} - 3\bar{D}^2)^{1/2}, \quad (5)$$

$$n = 0.2(9\bar{D}^{IV^2} - 24\bar{D}^{III^2})^{1/2}, \quad (6)$$

$$\bar{D}_K = 0.4264(10\bar{D}^2 - 3\bar{D}^{III^2})^{1/2}, \quad (5')$$

$$\bar{D}_K = (2.8\bar{D}^{III^2} - 0.8\bar{D}^{IV^2})^{1/2} \quad (6')$$

$\bar{D}_K$ can be found from Eqs.(5') or (6') only in the case of good statistics, since small statistical fluctuations in $\bar{D}^{III}$ or $\bar{D}^{IV}$ have a strong effect on $\bar{D}_K$. As the order of the difference increases, the contribution due to spurious scattering to this difference for a given cell will also increase. It is, therefore, desirable to determine this spurious scattering with the aid of the

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E032/E514

Measurement of Multiple Scattering on the Tracks of ~ 10 GeV Protons

higher order differences. The spurious scattering cannot be determined when the statistical error $\Delta D_{st} \simeq n$. When $\Delta D_{st} > n > D_K$ the energy cannot be determined at all. The best results for the energy when $\Delta D_{st} \simeq n$ are obtained when the scattering is measured using the optimum cell size t_{opt}. Chasnikov (Ref.10) has described a method for determining t_{opt} from the experimentally determined t_{min} for which $\bar{D}/t$ is a minimum. The quantity t_{opt} depends on the length of the track R and t_{min} in the following way:

$$t_{opt} \sim R^{\frac{1}{2(2-X)}} \; t_{min}^{\frac{3-2X}{2(2-X)}}$$

where t_{opt}, t_{min} and R are in units of 100 μ. According to the measurements carried out by the present authors and also other data $X < 1$. When $X = 0.5$, $t_{opt} = cR^{1/3}t_{min}^{2/3}$. With this value of X

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$t_m = t_o$, where t_o is the cell size corresponding to $D_K = n$. It should be noted that t_{min} is not always equal to t_o, since the spurious scattering index X may not be the same for different emulsions. In finding t_o it is convenient to use the ratios $\rho = \bar{D}^{III}/\bar{D}$ and $q = \bar{D}^{IV}/\bar{D}$. When $\bar{D}_K = n$, $\rho = 1.55$ and $q = 2.8$. However, in the presence of systematic distortions of tracks it is better to use the ratio $\bar{D}^{IV}/\bar{D}^{III}$ or the equivalent ratio q/ρ, which is less dependent on systematic errors. The following table gives the mean values of the second differences for different cells and also the values of ρ and q obtained in the present work.

t, mm	$\bar{D}$, μ	Number of second differences/ degree of overlapping	ρ	q
0.5	0.221	4960/1	1.75	3.23
1	0.333	4832/2	1.66	3.10
2	0.600	4592/4	1.44	2.58
4	1.529	3536/3	1.18	1.72
8	4.553	1344/16	1.12	1.87

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The following table gives the values of PV determined by different methods (in GeV)

t,mm	2	3	4	5	6
0.5	2.5	1.8	1.6	11.9±2.4	-
1	4.7	3.5	3	9.36± 0.67	9.8±2.0
2	7.7	6.5	6	8,98±0.90	10.7±1.0
4	8.8	9.1	8.7	-	9.82±0.63
8	8.6	9.3	9.1	-	9.96±1.5

The first, third and fourth columns give the values of PV without allowing for spurious scattering and based on second, third and fourth differences, respectively, with $\bar{D}_K$ assumed equal to $\bar{D}$, $\bar{D}^{III}/\varrho_K$, $\bar{D}^{IV}/q_K$. Columns 5 and 6 give the values obtained by

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S/120/60/000/005/002/051
E032/E514

Measurement of Multiple Scattering on the Tracks of ~ 10 GeV Protons

the multiple cell method and with the aid of Eq.(6'). It was found that in the emulsion used by the present authors the spurious scattering n follows the power law $n = 0.08\ t^{0.6}$. It is thus found that provided the spurious scattering is allowed for, the energy of charged particles can be determined by the multiple scattering method in the region of 10 GeV. At this energy the spurious scattering is negligible for a cell size of t = 4 mm.
Acknowledgments are made to V. I. Veksler and M.I.Podgoretskiy for supplying the nuclear emulsions irradiated with protons obtained from the above machine. There are 2 figures, 4 tables and 11 references: 3 Soviet, 1 German and 7 English.

ASSOCIATION: Institut yadernoy fiziki AN KazSSR (Institute of Nuclear Physics, AS, KazSSR)

SUBMITTED: July 14, 1959

Card 8/8

Takibayev Zh. S.

24.2120
10.2000(A)
24.6600

S/031/60/000/007/001/002
B2272

AUTHOR: Takibayev, Zh.S., Academician of the AS Kazakhskaya SSR

TITLE: The Fusion Reaction During Mutual Collisions of Light Nuclei

PERIODICAL: Vestnik akademii nauk Kazakhskoy SSR, 1960, No. 7, pp. 33 - 38

TEXT: The author describes some variants of a magnetic trapping vessel which, he suggests, may be of use in studying the fusion reaction of light nuclei (deuterons, tritons, etc.) when they mutually collide. Such a vessel, in which the density of the reacting particles increases rapidly with time, would be suitable for carrying out controlled fusion of light elements with a large gain in energy. The vessel consists of a toroidal chamber in which, for the sake of argument, a magnetic field of equal intensity at all points is present. The two beams of light nuclei, accelerated to an equal energy, are directed against each other, and the spatial charge in any section of the toroid neutralized by a third beam, the density of the currents of the negatively charged particles being roughly equal. The author examines the equations for the movement of particles in the toroidal magnetic chamber and shows that the particles will drift due to twisting of the lines of force of the magnetic field and to the inhomogeneity of the magnet-

Card 1/2

82272

S/031/60/000/007/001/002

The Fusion Reaction During Mutual Collisions of Light Nuclei

ic field within the toroid, and that the absolute speed of the particles varies little. To reduce drift of the particles, he suggests the use of a magnetic field of variable sign, which varies along the toroid; this may well be of use for plasma also. The use of magnetic mirrors (formed, e.g., by spiral currents) to reduce drift is not considered promising. Other variants discussed consist in the use of a transverse magnetic field and powerful focusing by magnetic lenses, and the system of particles which "catch each other up". In this method the deuterons and tritons are introduced into the transverse magnetic field in such a way that they move along the same orbit. There are 5 diagrams and 2 Soviet references.

4

Card 2/2

S/056/60/038/02/43/0[illegible]
B006/B014

AUTHOR: Takibayev, Zh. S.

TITLE: A Possible Effect of the Nucleon Structure in High-energy Interactions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 2, pp. 633 - 634

TEXT: The clarification of the relationship between the angular distribution of shower particles and their energy spectra and/or the distribution of Lorentz-invariant transverse momenta makes it possible to study the nucleon structure. The writer of the present "Letter to the Editor" reports on investigations of the relationship between the anisotropy of angular distribution of shower particles and the transverse components $p_\perp$ of their momenta. Fig. 1 shows this distribution of momentum components for four different showers: 2 + 16p, 2 + 14n, 2 + 15p, and 3 + 39p (Refs. 1, 5, 6). Only in the case of the third shower $p_\perp$ was not higher than $1.5\ m_\pi c$. Fig. 2 shows the integral angular distribution of the

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A Possible Effect of the Nucleon Structure in High-energy Interactions

S/056/60/038/02/43/061
B006/B014

first three shower types. The angular distribution of 3 + 39p is almost equal to that of 2 + 16p and 2 + 14n. A comparison of the resulting data indicates that in the case of anisotropic angular distribution the values of $p_\perp$ are mainly of the order of $m_\pi c$, and that $p_\perp$ often exceeds $m_\pi c$ in the case of low anisotropy (2 + 16p, 2 + 14n, 3 + 39p). From this the authors conclude that in the latter case the production of heavy mesons is to be expected, whereas in the case of strongly anisotropic angular distribution only pions will be produced. This relationship between the anisotropy of angular distribution and the distribution of the momentum transverse components was found to exist in showers induced by 10-Bev protons from the proton-synchrotron of the Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research). There are 2 figures and 6 references: 2 Soviet, 2 Italian, 1 German, and 1 American.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences of the Kazakhskaya SSR)

SUBMITTED: July 7, 1959

Card 2/2

Distribution of the Transverse Momentum of Shower Particles in Jets

83737
S/056/60/038/004/048/048
B006/B056

A direct comparison with the experimental angular distribution in the c m s. shows that even in this system the experimental angular distribution is considerably less anisotropic. This discrepancy does not occur if one assumes that the energy spectrum of the mesons produced is similar to the spectrum following from the Heisenberg theory (Ref. 1). (2) The hydrodynamic theory by L. D. Landau (Ref. 11) leads to a distribution of the $p_{\perp}$, which appears to be shifted into the region of high values of the transverse momenta; this is the consequence of an extremely hard energy spectrum of the mesons produced, such as is predicted by this theory. In a more exact variant of this theory as well as in the homogeneous variant (Refs. 14, 12) the distribution of the transverse momenta coincides with that obtained experimentally. (3) The Fermi theory (Ref. 15) in thermodynamic approximation does not lead to transverse momentum distributions agreeing with the experiment. (4) The transverse momentum distribution following from the Heisenberg theory (Refs. 1,10) agrees satisfactorily with the experiment. The energy spectrum of the produced particles resulting from this theory has been experimentally verified (Refs. 2-9). The angular distribution does not follow immediately from the theory, but it was qualitatively described by Heisenberg, who proceeded from the

Card 2/3

83737

Distribution of the Transverse Momentum of Shower Particles in Jets

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B006/B056

regular representation of the order of magnitude of the average transverse momenta. The angular distributions in the c.m.s. given on the basis of these representations in Ref. 10 have repeatedly been experimentally verified. (5) It is shown by analysis that the distribution of the transverse momentum amounts may be satisfactorily described both by the hydrodynamic theory and by Heisenberg's field theory. The experimentally observed distribution gives reference to neither of the two theories. I. L. Pomeranchuk, Ye. L. Feynberg and D. S. Chernavskiy, G. A. Milekhin, and I. L. Rozental' are mentioned. There are 8 figures and 25 references: 9 Soviet, 7 Italian, 4 German, 3 US, 1 Swiss, and 1 British.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences, Kazakhskaya SSR)

SUBMITTED: November 6, 1959

Card 3/3

S/020/60/135/003/017/039
B019/B077

AUTHORS: Takibayev, Zh. S., Academician of the Kazakhskaya SSR, Botvin, V. A., and Chasnikov, I. Ya.

TITLE: An Analysis of Some Inelastic p-n Interactions at an Energy of 9 Bev

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 135, No. 3, pp. 571-572

TEXT: In an emulsion pile - НИКФИ-Р (NIKFI-R) emulsions exposed in the proton synchrotron of the Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research) some events of inelastic p-n interaction were discovered. Out of 72 recorded events with three-pronged stars 22 were found where the complete identification of all secondary charged particles was possible. Ionization measurements and multiple Coulomb scatterings were used to identify these particles. The authors conclude from the studies of the angular distribution of the π^- mesons and the protons that the asymmetric angular distribution (measured to $\Delta \approx 0.55 \pm 0.24$) of the forward scattered secondary charged

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An Analysis of Some Inelastic p-n Interactions at an Energy of 9 Bev

S/020/60/135/003/017/039
B019/B077

particles for the p-n interaction in the center of mass system cannot be caused through the protons; (the proton angular distribution is practically symmetric but that of the pions is strongly asymmetric.) In order to guarantee this opinion further tests have to be carried out. The mean energy value of the protons and π mesons determined in the center of mass system amounts to $\overline{E}_p = 1.303 \pm 0.045$ Bev and $\overline{E}_\pi = 0.436 \pm 0.030$ Bev and the transverse impulse is $\overline{P}_p = 0.244 \pm 0.032$ Bev/c and $\overline{P}_\pi = 0.158 \pm 0.022$ Bev/c. Future publications are announced. There are 2 figures and 5 Soviet references.

SUBMITTED: May 16, 1960

Card 2/2

[illegible], M. S., [illegible], A. A., Abramov, G. S.

"[illegible] of Heavy Primaries of Energy [illegible]."

Report submitted to 4th Intl. Conf. on Cosmic Rays and Earth Storm (ICRES) Kyoto, Japan, 4-11 Sept. 1961.

S/058/61/000/010/009/100
A001/A101

3,2410

AUTHORS: Takibayev, Zh. S., Loktionov, A. A., San'ko, Shakhova, Ts. I.

TITLE: Analysis of angular distribution of thin tracks of showers produced by particles with energies of $> 10^{11}$ ev

PERIODICAL: Referativnyy zhurnal. Fizika, no. 10, 1961, 95, abstract 10B490 ("Tr. Mezhdunar. konferentsii po kosmich. lucham, 1959, v. 1", Moscow, AN SSSR, 1960, 51-60)

TEXT: The authors investigated the angular distribution of thin tracks of showers produced by cosmic ray particles with energies exceeding 10^{11} ev in the stratosphere. Characteristics of showers in the energy ranges 10^{11} ev $< E \leq 10^{12}$ ev and $E > 10^{12}$ ev are compared with various theoretical concepts. To explain a number of peculiarities in angular distribution (e.g., occurrence in some showers of distribution with two peaks), it is proposed to take into consideration the role of produced particles (antinucleons, π-mesons) in generation of additional particles at secondary collisions inside the target-nucleus. The angular distribution of shower particles produced by multi-charged particles is also analyzed.

B

Card 1/2

S/058/61/000/010/009/100
A001/A101

Analysis of angular distribution ...

A case is described, 15 + 515 Z, produced by a silicon nucleus with energy of ~ 600 Bev/nucleon.

L. Dorman

[Abstracter's note: Complete translation]

Card 2/2

3.2410 also 2412
24.6700

26415
S/056/61/041/001/010/021
B102/B214

AUTHORS: San'ko, L. A., Takibayev, Zh. S., Usik, P. A.

TITLE: Analysis of showers formed by high-energy cosmic-ray particles according to the model of excited nucleons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v.41, no. 1(7), 1961, 139-145

TEXT: High-energy interactions ($E > 10^{11}$ ev) of cosmic-ray nucleons in photographic emulsions are analyzed on the basis of the excited-nucleon model. A particular study is made of the angular distribution of the excited nucleons in the c.m.s. and its relationship to the angular distribution of the secondary shower particles in the lab system, as well as their multiplicity in the super-high energy range. Analysis is made of showers with $N_n \geq 2$ and $n_s \geq 6$ produced by single-charged or uncharged cosmic particles (nucleons) with $E > 10^{11}$ ev in the emulsion. 42 such showers were studied in all. The angular distribution of the excited nucleons in the c.m.s. was strongly anisotropic, small angles of emission

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Analysis of showers formed by ...

(25-30°) predominating; in many showers of smaller multiplicity, however, angles of emission of 70° were reached. The experimental results are compared with those obtained from the theory of peripheral interaction in single-meson pole approximation. Since the multiplicities were small, it was necessary to take the fluctuation of the particle numbers into account (cf. M. I. Podgoretskiy et al. ZhETF, 29, 296, 1955). Further, the dependence of the form of angular distribution of shower particles on their velocities of emission, and on the angle of emission of the excited nucleons in the c.m.s. is studied. The comparison of experimental and theoretical results has predominantly a qualitative character. The calculations made by other authors according to the theory of peripheric interaction (based on the perturbation theory) in single-meson pole approximation gave for nucleon-nucleon interaction at 9 Bev and 200-300 Bev good agreement with experiments, which shows that peripheric interaction at these energies plays an important role. In this approximation, the square of the four-momentum of the intermediate pion is given by

$$k^2 = -\left[1 - m_1^2 + \frac{4\gamma_c^2 + m_1^2 - m_2^2}{2} - 2\cos\vartheta' \sqrt{\gamma_c^2 - 1} \times \left[\left(\frac{4\gamma_c^2 + m_1^2 - m_2^2}{4\gamma_c}\right)^2 - m_1^2\right]^{1/2}\right]. \quad (5)$$

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Analysis of showers formed by ...

from this one obtains for symmetric excitation of the nucleons ($m_1=m_2=m$):

$$k^2 = -1 - m^2 + 2\gamma_c^2 - 2\sqrt{(\gamma_c^2-1)(\gamma_c^2-m^2)}\cos\vartheta'. \quad (6)$$

The distribution $k^2(H)$ calculated according to this formula is shown in Fig. 6. This result is compared with the data of I. M. Dremin and D. S. Chernavskiy. These workers had found that the total single-meson interaction cross section $\sigma_{NN}(E)$ at $E\sim 200$ Bev agrees with experimental values only when $\sigma_{\pi N}(k^2)$ is a smooth function of k^2 for $k^2 \leq (7\mu)^2$ and decreases rapidly with further increase of k^2. In the case considered here k^2 is essentially larger than $(7\mu)^2$; so this approximation cannot be used. The results of the investigations described here may be summarized as follows: The mass of the excited nucleons and the multiplicity of the generated mesons depend on the direction of motion of the excited nucleons in the c.m.s. The form of the angular distribution of the shower particles in the laboratory system depends on the velocity and direction of motion of the excited nucleons in the c.m.s. The transfer of four-momentum on nucleon interaction is, in all cases, large compared to $(7\mu)^2$. Therefore,

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Analysis of showers formed by ...

if the really excited nucleons are centers of emission of the shower mesons, and if the direction of their motion coincides with the cone axis, the excitation mechanism of the nucleons must deviate strongly from the single-meson interaction. M. I. Podgoretskiy is mentioned. There are 6 figures and 12 references: 6 Soviet-bloc and 6 non-Soviet-bloc.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences Kazakhskaya SSR)

SUBMITTED: December 26, 1960

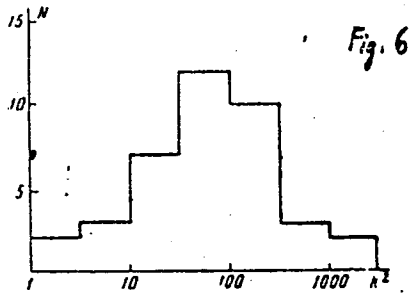

Fig. 6

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KOBZEV, V.A.; LUKIN, Yu.T.; TAKIBAYEV, Zh.S.; TSADIKOVA, G.R.; SHALAGINA, Ye.V.

Proton-proton interaction at an energy of 9 Mev. Zhur.eksp.i teor.fiz. 41 no.3:747-751 S '61. (MIRA 14:10)

1. Kazakhskiy gosudarstvennyy universitet.
(Protons) (Collisions (Nuclear physics))

BOTVIN, V.A.; TAKIBAYEV, Zh.S.; CHASNIKOV, I.Ya.; PAVLOVA, N.P.; BOOS, E.G.

Study of three-pointed stars resulting from inelastic pn-interactions in a nuclear emulsion at an energy of 9 Bev. Zhur. eksp.i teor.fiz. 41 no.4:993-1002 O '61. (MIRA 14:10)

1. Institut yadernoy fiziki AN Kazakhskoy SSR.
(Photography, Particle track) (Protons) (Neutrons)

32128 S/020/61/141/006/011/021
B104/B112

24.6400

AUTHORS: Takibayev, Zh. S., Academician AS Kazakhskaya SSR, Shalagina, Ye. V., and Tsadikova, G. R.

TITLE: Emission of high-energy α-particles in nuclear fissions by protons

PERIODICAL: Akademiya nauk SSSR Doklady, v. 141, no. 6, 1961, 1347-1349

TEXT: The authors proved the presence of α-particles with energies of the order of 1-2 Bev in stars produced by irradiation of emulsion piles with 9 Bev protons. These investigations were carried out in previous studies. Further experiments were conducted in the proton-synchrotron of the Ob"yedinennyy institut yadernykh issledovaniyy (Joint Institute of Nuclear Research) at Dubna to prove the correctness of particle identifications. The tracks of a series of very fast α-particles emitted in nuclear fissions were investigated. Results are given in Table 1. Energies of the 24 α-particles whose tracks were examined ranged between 100 and 2,000 Mev. Some of the tracks investigated may, however, have been produced by He^3 particles. It is assumed furthermore that G. O. Tleubergenov et al.

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32425

S/020/61/141/006/011/021
B104/B112

Emission of high-energy

also discovered high-energy α-particles emitted by stars which were produced by irradiation with 7 Bev mesons. The authors thank Academician V. I. Veksler and collaborators at the Joint Institute of Nuclear Research for cooperation and assistance. D. I. Blokhintsev (ZhETF, 33, 1295 (1957)) is mentioned. There are 2 figures, 1 table, and 10 references: 5 Soviet and 5 non-Soviet. The three most recent references to English-language publications read as follows: D. H. Perkins, Proc. Roy. Soc., A203, 399 (1950); S. Nakagawa, J. Phys. Soc., 12, 747 (1957); V. T. Cocconi et al., Phys. Rev. Letters, 5, no. 1, 19 (1960).

ASSOCIATION: Kazakhskiy gosudarstvennyy universitet im. S. M. Kirova (Kazakh State University imeni S. M. Kirov)

SUBMITTED: August 14, 1961

Table 1. Investigation results of 14 tracks of α-particles by two different methods. Legend: (1) Number of track; (2) kinetic energy, Mev; (3) angle with respect to the primary direction; (4) ε as a function of R; (4a) in second interaction, ε not measured; (4b) ditto; (5) E_K dependent on R; (5a) useless because track could not be traced to its end; (6) ε

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Emission of high-energy ...

dependent on E_k; (6a) not measured; (6b) ditto; (7) identification according to width of track; (7a) useless; (7b) α-particles; (7c) ditto; (8) identification according to constant sagitta; (8a) useless; (8b) α-particles; (9) dependence b-R; (9a) useless; (9b) α-particles; (10) type of primary star.

Card 3/4

39305
S/707/62/005/000/001/012
D290/D308

AUTHORS: Batvin, V.A., Takibayev, Zh.S., Chasnikov, I.Ya., Bo[illegible], L.G. and Pavlova, N.F.

TITLE: Analysis of some inelastic p-n-interactions at 9 Bev

SOURCE: Akad. nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy. v. 5, Alma-Ata, 1962. Fizika chastits vysokikh energiy. Struktura yadra, 3-15

TEXT: The authors studied in detail the characteristics of the secondary particles from three-ray p-n-interactions produced by 9 Bev protons; the work was carried out because of appreciable differences in the results for such reactions given in the literature. Nuclear emulsions type НИКФИ-Р(NIKFI-R) were used. The aggregate angular distribution of π -mesons and protons is symmetrical in the center-of-mass system (CMS); the individual angular distribution for π -mesons and protons are asymmetric in CMS, protons predominating in the back direction and π -mesons in the forward direction. The energy spectrum of protons in CMS is harder than that predicted by

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S/707/62/005/000/001/011
D290/D308

Analysis of some inelastic ...

the statistical theory with allowance for isobars. The energy spectrum of π -mesons in C, at high energies approximates to a Heisenberg spectrum, except that the maximum in the theoretical spectrum occurs at an appreciably lower energy; the spectrum predicted by the statistical theory with allowance for isobars is harder for all energies. The measured inelasticity coefficients show that for protons and π -mesons half the energy concerned in meson production is carried away by π^0 -mesons; this indicates that equal numbers of π^0 - and $\pi^\pm$ -mesons are produced provided that the energy spectra of neutral and charged mesons are identical. The average energy carried away per charged π -meson or proton does not depend on the type of reaction. The distribution of the true inelasticity coefficient does not show a sharply defined maximum; there are indications of the presence of two maxima but this is only a tentative conclusion. There are 13 figures and 4 tables.

Card 2/2

39306
S/707/62/005/000/002/014
D290/D308

AUTHORS: Boos, E.G., Takibayev, Zh.S., Botvin, V.A., Chasnikov, I.Ya. and Pavlova, N.P.

TITLE: Analysis of p-nucleon interactions produced at an energy of 10^{10} eV in nuclear photoemulsion

SOURCE: Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy. v. 5. Alma-Ata, 1962. Fizika chastits vysokikh energiy. Struktura yadra, 16-32

TEXT: The authors have developed a new method of finding the angular and energy characteristics of nuclear disintegrations that is based on the calculation of the distribution of transverse momentum of secondary particles; for all identifiable particles the method gives closer agreement with experiment than other methods of approximation. The method permits an estimate of the dependence of the following characteristics on observed multiplicity: a) the degree of anisotropy of the angular distribution of shower particles in the center-of-mass system (CMS) for a Lorentz-factor (γ_c) of 2.4 decreases with increasing multiplicity; for 3- and 8-ray stars

Card 1/3

Analysis of p-nucleon interactions ...

there is an appreciable asymmetry in forward and backward emission of particles, b) in the region of average multiplicity (between 3 and 8) the best agreement with the expected value $\gamma_c = 2.4$ is shown by a quantity found by a kinematic method which assumes a uniform distribution of the transverse momenta of shower particles; the assumption $\beta_c / \beta_i' = 1$ (β_c is the velocity of the center-of-mass with respect to laboratory coordinates (LC), β_i' is the velocity of the particles in CMS) leads to a systematic overestimate of the energy by a factor of two. Regardless of the method of estimation, γ_c for 3-ray stars is too high, while γ_c for 8-ray stars is too low; therefore the Lorentz-factor of the system where angular symmetry of the secondary particles is assumed, will decrease as the multiplicity increases, c) as the multiplicity increases, the fraction of the energy carried off by charged meson increases both in LC and CMS, but the fraction of the energy per meson is almost unchanged (about 17%); therefore $n_{\pi^0}/n_{\pi^\pm} < 0.5$ for 7- and 8-ray stars provided that the energy spectra $n_{\pi^0}/n_{\pi^\pm}$ of π^0 and $\pi^\pm$ -mesons are identical. The mass of the target also increases with the multi-

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plicity, but it does not exceed the mass of nucleon; this confirms the criteria for the selection of n-n-interactions. The authors acknowledge the help of L.I. Mikhaylova and O.V. Gunenkova. There are 8 figures and 4 tables.

1

Card 3/3

S/707/62/005/000/007/014
D290/D308

AUTHORS: Lazarev, N.N., Lazareva, T.P. and Takibayev, Zh.S.

TITLE: Multiply-charged particles from cosmic-ray stars

SOURCE: Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy, v. 5. Alma-Ata, 1962. Fizika chastits vysokikh energiy. Struktura yadra, 96-101

TEXT: The authors studied multiply-charged particles (fragments) from cosmic ray stars produced in emulsions at a height of about 30 km. The charge of a fragment that is stopped in the emulsion can be found from the width of the last 150 μ of its track. The unstable $^{8}_{3}$Li particles have an angular distribution that is nearly isotropic and an energy spectrum that agrees well with that predicted by the evaporation theory, therefore most of the $^{8}_{3}$Li particles are probably evaporated from excited nuclei. The stable particles with Z = 3 and energy greater than 60 Mev have a strongly anisotropic angular distribution (the ratio of the numbers in the forward and back directions is 45/2) and an energy spectrum that cannot

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S/707/62/005/000/007/014
D290/D308

Multiply-charged particles ...

be described by the evaporation theory; these particles probably originate in a cascade process. The angular and energy distributions of fast particles with $Z \gg 4$ agree with the hypothesis that they are produced in a cascade process. The charge distribution of the fragments decreases less sharply with Z than in Nakagawa's work (Ref. 5: Nakagawa, S., J. Nuovo Cim., 9, 780, 1958). The probability of emission of a fragment depends on the number of grey tracks in the star and not on the number of fine tracks. There are 8 figures.

Card 2/2

26...12
AI6746

S/707/62/005/000/012/014
D290/D308

AUTHOR: Takibayev, Zh.S.

TITLE: A magnetic trap for colliding beams

SOURCE: Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki. Trudy, v. 5. Alma-Ata, 1962. Fizika chastits vysokikh energiy. Struktura yadra, 147-154

TEXT: The author discusses the possibility of using colliding beams of deuterons and tritons to initiate a self-sustaining nuclear fusion reaction, and suggests a method of confining the colliding beams by a suitable magnetic field configuration; he has also discussed the subject in an earlier paper (Ref. 13: Takibayev, Zh.S. Vest. AN KazSSR', 7 (184), 33, 1960). The author estimates that the power generated by the fusion reaction during the collision of two accelerated beams would be 1 kwatt/cm^3 for the deuteron-deuteron reaction and 200 kwatt/cm^3 for the deuteron-triton reaction; he concludes that the method could be used to initiate a self-sustaining reaction. He considered the collision of two 50 kev beams and the

Card 1/2

A magnetic trap for colliding beams

S/707/62/005/000/012/014
D290/D308

injection of a third beam of electrons in order to neutralize the space charge, and gives the results of calculations of the motion of charged particles in a toroidal magnetic field. He suggests the use of a toroid that is divided into sections so that the axial magnetic field is reversed in successive sections; in this way the beams would be confined and the particles would perform slow axial oscillations; this method is shown to be superior to a figure-of-eight system. A supplementary field must be provided in order to return scattered particles into the beam and to improve the focussing of the beam; a suitable field can be produced if four conductors are wound around the toroid and inclined at a small angle to its axis. There are 6 figures.

SUBMITTED: 1960

Card 2/2

S/048/62/026/005/006/022
B108/B104

AUTHORS: Takibayev, Zh. S., Kobzev, V. A., Tsadikova, G. R., and Shalagina, Ye. V.

TITLE: Emission of doubly-charged high-energy particles in proton-induced nuclear fission processes

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 5, 1962, 592-595

TEXT: In order to find the origin of the high-energy fragments from star-type nuclear fission processes induced by cosmic rays, the authors looked for doubly-charged high-energy particles in stars caused by 9-Bev protons in photoemulsion. The traces of all Z=2 particles were identified as belonging to alphas with energies ranging from about 100 to about 2000 Mev. Some of these traces, however, may also pertain to He^3 nuclei which are difficult to distinguish from alphas. There are 3 figures and 1 table.

Card 1/1

S/040/62/026/005/007/022
B108/B104

AUTHORS: Loktionov, A. A., and Takibayev, Zh. S.

TITLE: Showers produced by nuclei with $\gtrsim 5 \cdot 10^{10}$ ev per nucleon

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 5, 1962, 596-603

TEXT: Showers are the best means for studying head-on collisions between nucleons. The authors therefore studied showers induced by heavy nuclei ($Z > 2$). Conclusions: High-energy nuclei undergo a tube-type interaction during the collision with emulsion nuclei. If the primary particles are nucleons, this tube model can only be applied to extremely high energies. The dependence of multiplicity on the energy in nucleus-induced showers is not uniform: for alphas ($5 \cdot 10^{10}$-$5 \cdot 10^{13}$ ev per nucleon), $n_s \sim E^{0.15 \pm 0.03} - E^{0.29 \pm 0.01}$, and $r_{n_s,E} = 0.65 - 0.95$; for n-n showers, $n_s \sim E^{0.05}$, and $r_{n_s,E} \sim 0.5$. The degree of anisotropy in the angular

Card 1/2

Distribution of the shower particles is $\sim(0.066 \pm 0.008)\log(E/2M)$ for nuclear showers, and $\sim(0.146 \pm 0.009)\log(E/2M)$ for nucleon-induced showers. This difference cannot be attributed to a dependence of the angular distribution on the tube length. An angular distribution with two maxima for nuclear showers is only possible at energies $\geq 5 \cdot 10^{12}$ ev per nucleon. The coefficient of inelasticity in head-on collisions between alpha and emulsion nuclei is independent of energy, and equals 0.4-0.6. The average of the quantity N_h, which may serve as a measure for the excitation of the target nucleus, is determined by the tube volume, and is independent of the primary-particle energy: $\overline{N}_h = (0.85 \pm 0.1)A_a^{\frac{1}{3}}(1' + 1)$ at $E \geq 5 \cdot 10^{10}$ ev per nucleon. Nucleus-nucleus interaction does not lead to superposition of the individual n-n collisions. Nucleus-nucleus collisions are accomplished chiefly by head-on collisions. There are 4 figures and 1 table.

Card 2/2

3954
S/048/62/026/005/008/022
B108/B104

AUTHORS: Sukhov, L. A., Takibayev, Zh. S., and Usik, P. A.

TITLE: Study of showers produced by high-energy cosmic-ray particles according to the model of excited nucleons

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 5, 1962, 604-612

TEXT: The emission of pions takes place, not during, but some time after a nucleon-nucleon collision. This is due to excited nucleons emitting the pion. The angular distribution of such excited nucleons may give information on the nucleon interaction mechanism at very high energies. Experimental results indicate that the mass of the excited nucleons, and consequently, also the multiplicity of the resulting mesons depend on the direction of motion of the excited nucleons in the cms. The four-momentum transfer during nucleon interaction with consideration of the twist angle is always greater than $(7\mu)^2$. Therefore, if the emission centers of shower mesons are really excited nucleons, and if they move along the axis

Card 1/2

Study of showers produced... S/048/62/026/005/008/022
B108/B104

of the shower cones, the nucleon excitation mechanism must be different from single-meson interaction. The longitudinal component of the transferred momentum makes a greater contribution to the excitation of the nucleons than does its transverse component. The latter essentially determines the twist angle of the excited nucleons. There are 8 figures.

Card 2/2

S/056/62/042/001/001/048
B125/B108

AUTHORS: Boos, E. G., Botvin, V. A., Pavlova, N. P., Takibayev, Zh. S., Chasnikov, I. Ya.

TITLE: Analysis of 9-Bev proton-nucleon interaction in a nuclear emulsion

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 1, 1962, 3 - 11

TEXT: A constant distribution of transverse momenta is assumed for the suggested method of studying the dependence of angular and energy characteristics of proton-nucleon interaction on multiplicity. All showers observed in a P (R) type НИКФИ (NIKFI) emulsion irradiated with 9-Bev protons from the proton synchrotron of the OIYaI were classified according to their multiplicity. The transverse momenta of the secondary particles are constant over a wide range of primary particle energies and depend only slightly on multiplicity and target mass. The experimental distribution of $p_\perp$ is satisfactorily approximated by $\Delta N/N\Delta p_\perp = cp_\perp \exp(-p_\perp^2/b^2)$ [1]. Owing

S/056/62/042/[illegible]/[illegible]
B125/B108

Analysis of [illegible]-Bev proton-nucleon...

to the law of conservation of momentum, the mean value of $P_\perp$ increases with increasing Θ in the case of small angles. Results of this method show better agreement with the experiment than earlier methods. The angular distribution of shower particles becomes more isotropic (in the c.m.s) with increasing multiplicity. The particle emission of the 3 and 8-pronged stars forward and backward is not symmetric. The best agreement with the expected Lorentz factor ($\gamma_c = 2.4$) is attained for mean multiplicities ($3 < n_s < 8$). The Lorentz factor tends to a decrease with increasing multiplicity. The portion of energy imparted to charged mesons increases with multiplicity in both the laboratory and center-of-mass systems. Hence, $n(\pi^0)/n(\pi^\pm) < 0.5$ for 7 or 8-pronged stars with equal energy spectra of π^0 and $\pi^\pm$ mesons. The estimable mass of the target particles increases with multiplicity, but does not exceed the nucleon mass estimated by N. G. Birger and Yu. A. Smorodin (ZhETF, 36, 1159, 1959). This justifies the criteria of selecting nucleon-nucleon interactions. The coworkers of the OIYaI are thanked for discussions. I. M. Gramenitskiy and M. I. Podgoretskiy for supplying their preprint on the angular distribution of particles in 8-pronged stars. There are 7 figures, 1 table, and 15 references: 11 Soviet and 4 non-Soviet.

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Analysis of 9-Bev proton-nucleon... S/056/62/042/001/001/048
B125/B108

The reference to the English-language publication reads as follows:
P. L. Jain, E. Lohrmann, M. W. Teucher. Phys. Rev., 115, 643, 1959.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR
(Institute of Nuclear Physics of the Academy of Sciences
Kazakhskaya SSR)

SUBMITTED: January 30, 1961

Card 3/4

G. BOOS, V. V. VISKOV, L. I. DORMAN, Ye. V. KOLOMEYETS, Zh. S. TAKIBAYEV

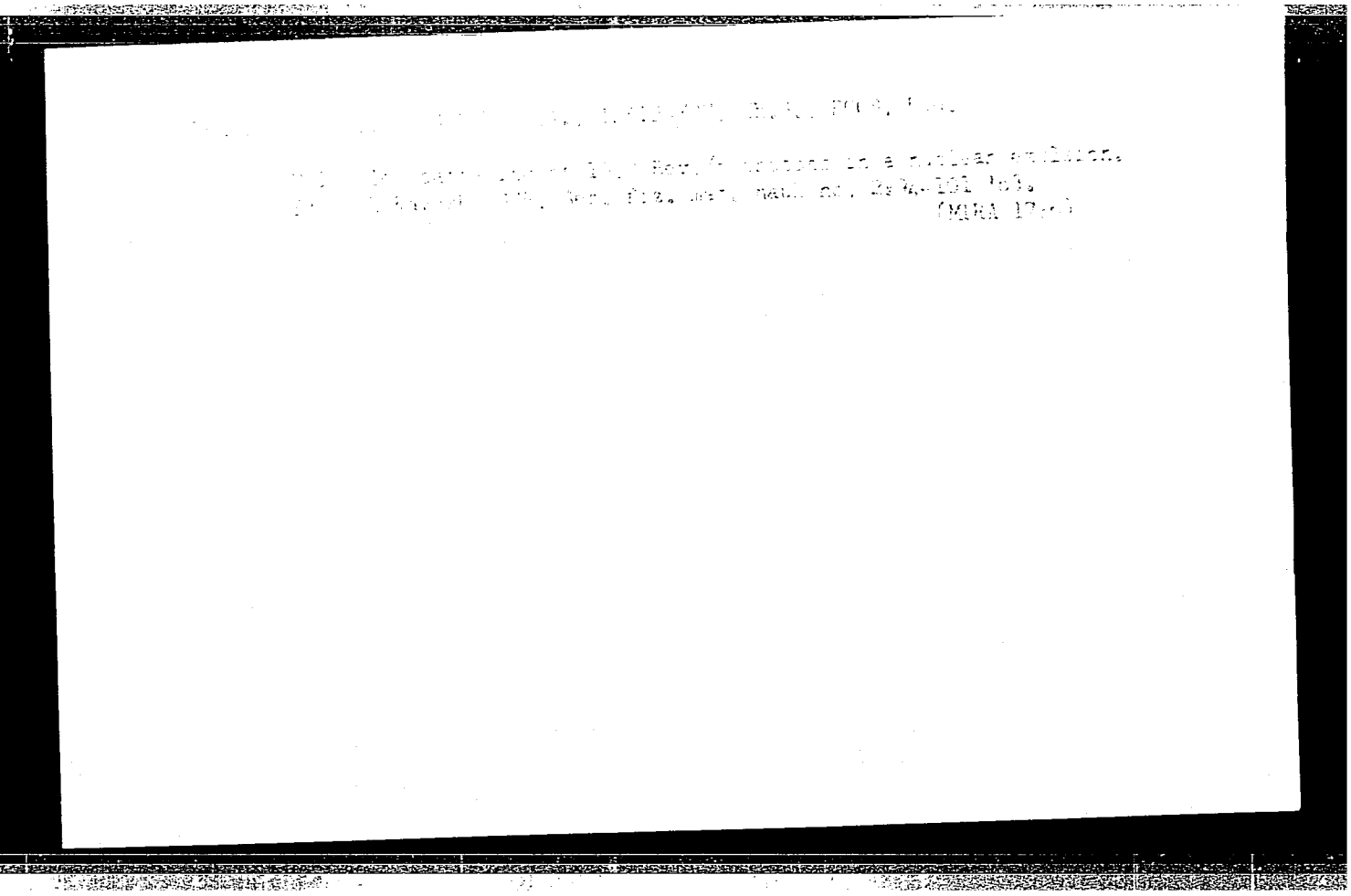
... calculations of the integral multiplicity for Mu-meson and nucleon component production duet to the different energies of primaries obtained at the top of the atmosphere with different zenith angles.

report submitted for the 8th Intl. Conf. on Cosmic Rays (IUPAP), Jaipur India, 9-14 Dec 1963

. . A. SANKO, Zh. S. TAKIBAYEV, P. A. USIK

Investigation of the Jets above 10^{11}ev

Report submitted for the 8th Intl. Conf. on Cosmic Rays (IUPAP), Jaipur, India, 2-[illegible] Dec 1963



TAKIBAYEV, Zh.S., BOOS, E.G., PAVLOVA, N.P.

Distribution of transverse pulses of particles in nucleon interactions. Trudy Inst. fiz. AN Kazakh. SSR 6:(90-9) '59. (MIRA 16:10)

TAKIBAYEV, Zh.S.; CHASNIKOV, I.Ya.; SHAKHOVA, TS.I.; ANZON, Z.V.

Two-prong stars formed in inelastic pp-interactions at 9 Bev.
Trudy Inst. iad. fiz. AN Kazakh. SSR 6:94-100 '63.
(MIRA 16:10)

KOBZEV, V.A., TAKIBAYEV, Zh.S.; SHALAGINA, Ye.V.; SHTERN, G.R.

Analysis of high-energy helium isotopes emitted in the interaction of protons with photoemulsion nuclei. Trudy Inst. iad. fiz. AN Kazakh. SSR 6:133-139 '63. (MIRA 16:10)

VINITSKIY, A.Kh.; GOLYAK, I.G.; PAVLOVA, N.P.; RUS'KIN, V.I.; TAKIBAYEV, Zh.S.

Inelastic π-N-interactions at 7.5 Bev. Trudy Inst. iad. fiz. AN Kazakh. SSR 6:144-159 '63. (MIRA 16:10)

TAKIBAYEV, Zh.S., akademik

Results of the scientific work of agencies of the Department of Physical and Mathematical Sciences in 1962 and future tasks. Vest. AN Kazakh. SSR 19 no.4:52-57 Ap '63. (MIRA 16:5)

1. Akademik-sekretar' otdeleniya fiziko-matematicheskikh nauk AN Kazakhskoy SSR.
(Academy of Sciences of the Kazakh S.S.R.)

S/056/63/044/002/006/065
B102/B186

AUTHORS: Vinitskiy, A. Kh., Golyak, I. G., Rus'kin, V. I., Takibayev, Zh. S.

TITLE: Interaction between 7.5-Bev π^- mesons and nucleons, and their analysis on the basis of pole graphs

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 2, 1963, 424-430

TEXT: Emulsion plates were exposed to the pion beam from the proton-synchrotron of the OIYaI, and from the 2100 πN events recorded 200 elastic interactions were selected and analyzed. Among these there were 48, 56, 45, 29, 11, 10 and 1 events of 2, 3, 4, 5, 6, 7, and 8-pronged stars, respectively. A total of 323 particles were identified, 259 pions, 19 K-mesons and 45 protons. The pion and proton angular and momentum distributions were determined for the c.m.s. The pion angular distribution is asymmetric with a forward peak and the asymmetry decreases with increasing multiplicity. The proton angular distribution has a backward peak, but the asymmetry is independent of the multiplicity. The proton

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Interaction ... between 7.5-Bev ...

S/056/63/044/002/006/065
B102/B186

... distribution has two maxima at 0.4-0.6 Bev/c and at 1.4-1.6 Bev/c. ... have flat maxima at 0.2-0.4 and 0.6-0.8 Bev/c. The ... results are analyzed from the standpoint of peripheral ... applying the Feynman graphs for one-, two- and three-pion ... peculiarities observed can be explained by the fact that at ... stars have only few prongs. The angular correlation ... in the case of low multiplicity are also discussed. ... and 2 tables.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences Kazakhskaya SSR)

SUBMITTED: July 28, 1962

Card 2/2

CHASNIKOV, I.Ya.; ANZON, Z.V.; TAKIBAYEV, Zh.S.; STREL'TSOV, I.S.

Identification of particles by the photographic emulsion technique. Zhur. eksp. i teor. fiz. 45 no.2:29-37 Ag '63. (MIRA 16:9)

1. Institut yadernoy fiziki AN Kazakhskoy SSR.
(Photography, Particle track)

S/020/63/148/004/011/025
B141/B102

AUTHORS: Vinitskiy, A. Kh., Golyak, I. G., Pus'kin, V. I., Takibayev, Zh. S., Academician AS KazSSR

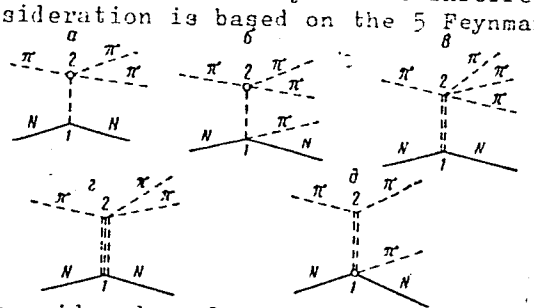
TITLE: Investigation into particle production in inelastic pion-nucleon interactions

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 148, no. 4, 1963, 796-798

TEXT: The production of pions, strange particles, and new rapidly decaying systems is studied in inelastic interactions between 7.5-Bev pions and the nucleons of a nuclear emulsion. Out of 2100 interactions recorded, 200 were classified as inelastic pion-nucleon interactions; and among the 323 particles identified there were 259 pions, 19 K-mesons, and 45 protons. The angular distributions of the secondary protons and pions was studied, as well as their momentum distributions, which have 2 maxima. The protons of the (πp) collisions have less energy than those of the πn) collisions. The c.m.s. K-meson energy fluctuates between 500 and 700 Mev. In 3 cases 2 K mesons were produced simultaneously in inelastic (πN) interactions. Their mass was approximately 1 Bev

Card 1/3

(lab-system). A resonance of the KK system is inferred from this fact. The theoretical consideration is based on the 5 Feynman graphs of the figure.



Graphs a and д are considered on 2 assumptions, (1) $\sigma_{\pi\pi}(\omega^2)$=const. (2) $\sigma_{\pi\pi}$ is obtained from the Breit-Wigner resonance formula for T = I = 1. The graphs в, г, д describe (πN) interactions with exchange of quasiparticles. The graphs б, г, and д supply the main contribution in the high-energy peak in the proton momentum distribution at 1.4-1.6 Bev; this maximum can be explained, the other one, at 0.4-0.6 Bev cannot be explained by а-д. There are two further possible explanations: (1) that the maximum is due

to nonpolar processes that are connected with a high momentum transfer to protons; (2) it could be explained by a certain type of pole graph. There are 4 figures and 1 table.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk KazSSR (Institute of Nuclear Physics of the Academy of Sciences KazSSR)

SUBMITTED: July 13, 1962

Card 3/3

L 16013-65 EWT(m) DIAAP/SSD/AEDC(a)/AFWL/ESD(gs)/ESD(t) S/0048/64/028/011/1741/1750
ACCESSION NR: AP4049586

AUTHOR: Grigorov, N.L.; Dobrotin, N.A.; Zhdanov, G.B.; Takibayev, Zh.S. B

TITLE: Experimental investigation of nuclear interactions at energies from 10^{11} to 10^{13} eV /Report, All-Union Conference on the Physics of Cosmic Rays held in Moscow 4 to 10 Oct 1963/

SOURCE: AN SSSR. Izv. Seriya fizicheskaya, v.28, no.11, 1964, 1741-1750

TOPIC TAGS: cosmic rays, high energy interaction, nuclear physics, nuclear reaction

ABSTRACT: The paper is primarily a general review of recent experimental work, mainly by Soviet scientists, on nuclear processes occurring at very high energies ($E \gg Mc^2$), specifically, in the 10^{11} to 10^{13} eV range. It is noted that nuclear processes in this energy range are characterized by very slow variation of their characteristics (cross section, etc.) with energy, which makes it imperative to encompass a wide energy interval in order to discover trends and regularities. Mention is made of some theoretical evaluations as well as confirming or independent experimental studies by means of pellicle stacks, ionization calorimeters, various counter and chamber arrays, and spark chambers (the merits of the last are stressed),

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aimed at determining gamma-ray spectra, particle distribution, shower particle spectra, etc. The fire-ball model is discussed in connection with some of the briefly described experimental results and theoretical hypotheses. Mainly, only fragmentary or general data are given. Among the experimental problems suggested for further study in the immediate future are measurement of the inelasticity coefficient and its variation in magnitude in nucleon-nucleon interactions, determination of the variation of the inelasticity coefficient and interaction cross section with the atomic number in nucleon-nucleus interactions, clarification of the role played by the fire-ball mechanism in nucleon-nucleus and pion-nucleon interactions, determination of the significance of the process of pion production via decay of isobars and comparison of neutral and charged pion production processes, determination of the relative importance of central collision processes interactions at different energies, and determination of the fraction of different strange particles created at different primary particle energies. It is hoped that solutions to some of these problems will be provided by the new cosmic ray research equipment now being installed at mountain altitudes in the Soviet Union. These installations consist of large Wilson chambers in a magnetic field and several trays of ionization calorimeters. The largest installation of this type is now being constructed in the Georgian SSR at an elevation of 2200 meters; this will be equipped with 2 x 2 meter Wil-

L 16013-65
ACCESSION NR: AP4049586

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son chambers and a 1000 ton electromagnet. Orig. art. has 5 figures.

ASSOCIATION: Nauchno-issledovatel'skiy institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta im. M. V. Lomonosova (Scientific Research Institute of Nuclear Physics, Moscow State University); Fizicheskiy institut P. N. Lebedeva Akademii nauk SSSR (Physics Institute, Academy of Sciences, SSSR); Institut yadernoy fiziki Akademii nauk KazSSR (Institute of Nuclear Physics, Academy of Sciences, KazSSR)

SUBMITTED: 00 ENCL: 00

SUB CODE: AA, NP NO REF SOV: 021 OTHER: 001

Card 3/3

L 40706-65 EWG(j)/EWT(m)/FCC/T IJP(c)

ACCESSION NR: AP5012315 UR/0048/64/028/011/1767/1769

23
B

AUTHOR: Takibayev, Zh. S.; San'ko, L. A.; Usik, P. A.

TITLE: Curves for 10^{11}-10^{14} eV shower /Report of All-Union Meeting on Cosmic Rays Physics, held in Moscow from October 4 to 10, 1963/

SOURCE: AN SSSR. Izvestiya fizicheskaya, v.28, no. 11, 1964, 1767-1769

19

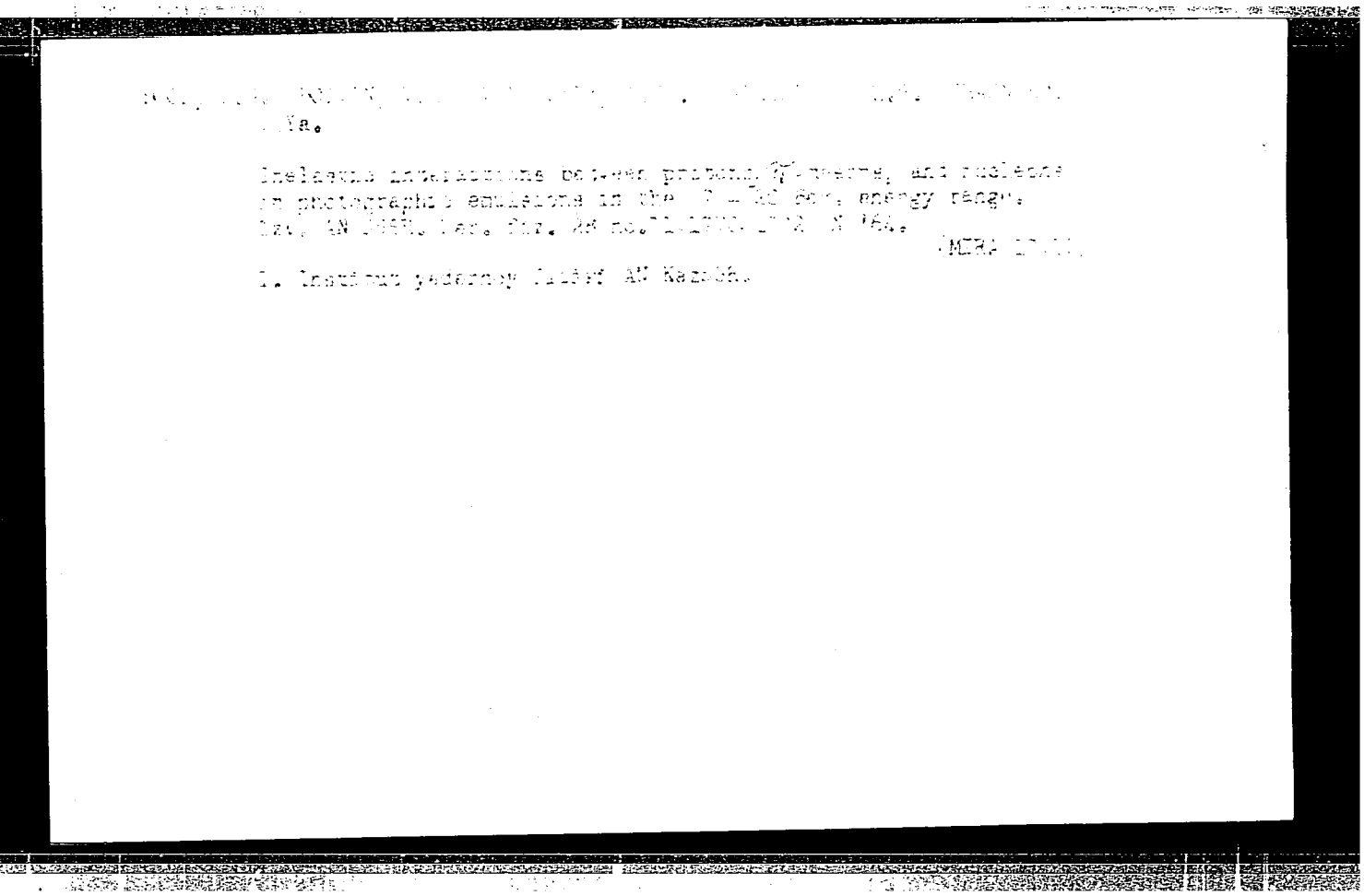
TOPIC TAGS: cosmic ray shower, nuclear particle, particle interaction

ABSTRACT: Analysis of contradictions arising from a model for excited nucleons and a fire-ball model with experimental data on jets resulted in a model for intermediate resononssic and baryon pairs. Certain characteristics of jets are discussed from the aspect of the formation of shower particles principally from intermediate pi-pi-interaction with single pion exchange. The experimental data considered covers a wide range of primary energies.
Orig.art. has: 6 formulas and 3 graphs.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk KazSSR (Institute of Nuclear Physics, Academy of Sciences KazSSR)

SUBMITTED: 00 ENCL: 00 SUB CODE: AA, NP
NO REF SOV: 006 OTHER: 001 JPRS

Card 1/1 mfs



L 52195-65 EWG(j)/EWT(l)/EWG(v)/FCC/EEC-4/EEC(t)/T/EWA(h)/EWT(m) Po-4/Pe-5/Pq-4/
Pae-2/Peb/Pi-4 IJP(c) GM

ACCESSION NR: AP5017046 UR/0048/64/028/012/2022/2025 58 B

AUTHOR: Boos, E. G.; Viskov, V. V.; Dorman, L. I.; Kolomeyets, Ye. V.; Takibayev, Zh. S.

TITLE: Bonding coefficients for various cosmic ray components 19 Report of the All-Union Conference for the Physics of Cosmic Rays, held in Moscow, 4-10 October, 1963

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 28, no. 12, 1964, 2022-2025

TOPIC TAGS: cosmic ray, γ particle interaction, particle motion, astrophysics

ABSTRACT: Bonding coefficients which are used to study variations in cosmic rays are computed on the basis of the character of an elementary event of the interaction of a primary nucleon with nuclei of atmospheric atoms in which the spatial distribution of a nuclear cascade in the atmosphere is taken into account. This problem was solved earlier in the one-dimensional approximation for a vertical flow of primary particles. In this article the angular spread of particles is considered. The bonding coefficients are derived for the mu-meson component. It is assumed that a primary particle loses the same

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L 52195-65

ACCESSION NR: AP5017046

amount of energy in each interaction event, since only pi-mesons are generated. The contribution of delta nucleons to the generation of pi-mesons is neglected.

Orig. art. has: 17 formulas

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: AA, NP

NO REF SOV: 002 OTHER: 000 JPRS

Card 2/2

L 22173-65 EWT(m) SSD/AFWL/SSD(c)/DIAAP

ACCESSION NR: AP5001823 S/0056/64/047/006/2041/2050

AUTHORS: Boos, E. G.; Pavlova, N. P.; Takibayev, Zh. S.; Temiraliyev, T.; Tursunov, R. A.

TITLE: Investigation of the interaction of 19.8-GeV/c protons with nucleons in emulsion nuclei

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 47, no. 6, 1964, 2041-2050

TOPIC TAGS: proton nucleon interaction, proton scattering, emulsion, proton proton interaction, proton neutron interaction

ABSTRACT: The investigation was made with a stack of 600 μ Ilford G-5 emulsions measuring 12 x 20 cm, irradiated in the CERN proton synchrotron. Scanning was along the tracks of the primary particles in an MBI-9 microscope with a magnification of 900x. The criteria used to select interactions in free and quasi-free nucleons

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are described. Altogether 7,960 events were detected in a total primary track length of 2,927 meters (corresponding to a mean free path 36.8 ± 0.4 cm). From these, 1,035 elastic p-N interactions were selected. The distribution of the p-p events with respect to the number of prongs is in agreement with hydrogen bubble chamber data. The mean number of charged secondary particles from p-p and p-n interactions are 4.3 ± 0.2 and 4.5 ± 0.2, respectively. Showers with asymmetric emission of charged particles in the c.m.s. were also investigated. The distribution of the asymmetry of the individual interactions can be explained by assuming that the shower particles are deflected from symmetric emission in random fashion. The dependence of the multiplicity on the type of target nucleus is analyzed, and the experimental data are compared with the predictions of various theoretical mechanisms for the interaction between the nucleons and nuclei. It is shown that the best agreement is obtained with the cascade model calculations performed at OIYaI. "The authors thank the members of the High Energy Labora-

L 22173-65

ACCESSION NR: AP5001823

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tory of IYaF AN KazSSR, M. G. Antonova, O. V. Guvenkova, L. Ya. Kogasova and V. L. Pervuchina for experimental data reduction, and the emulsion committee of CERN for supplying the pellicle stack." Orig. art. has: 3 figures, 4 formulas, and 9 tables.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics, Academy of Sciences Kazakh SSR)

SUBMITTED: 04May64 ENCL: 00

SUB CODE: NP NR REF SOV: 012 OTHER: 014

Card 3/3

L 22175-65 EWT(1)/EWT(m)/T/EED(b)-3 Pae-2 SSD(a)/SSD(c)/AEDC(a)/AS(mp)-2/
DIAAP/IJP(c)
ACCESSION NR: AP5001824 S/0056/64/047/006/2051/2054

AUTHORS: Anzon, Z. V.; Vinitskiy, A. Kh.; Takibayev, Zh. S.; Chasnikov, I. Ya.; Shakhova, Ts. I.

TITLE: Investigation of ionization losses of relativistic particles in nuclear photoemulsions

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 47, no. 6, 1964, 2051-2054

TOPIC TAGS: nuclear emulsion, ionization, relativistic particle, proton interaction, relativistic particle

ABSTRACT: The purpose of the work was to study the dependence of the ionization characteristic (blob density) on the particle energy (in rest-mass units). To this end, the authors carried out special measurements of the relative ionization in tracks of protons of energy 2, 3, 4 and 5 BeV and pions of 3.8 BeV energy, in stacks of

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L 22175-65
ACCESSION NR: AP5001824

NIKFI-R emulsions irradiated at the Joint Institute of Nuclear Research. The stacks were irradiated practically simultaneously in a 9 BeV proton beam, in a direction perpendicular to the emulsion plane. Results obtained from tracks of electron-positron pairs and delta rays in a stack of 600 μ Ilford G-5 emulsion irradiated by 17-BeV pions in the CERN accelerator are also presented. The ratio of the ionization on the plateau of the ionization curve to the value at the minimum coincides for the different emulsions within the limits of experimental error. The average value of this ratio is 1.104 ± 0.010. The observed ionization-momentum dependence agrees with the curve calculated on the basis of the Sternheimer equation (Phys. Rev. v. 88, 851, 1952; 89, 1148, 1953; 91, 256, 1953; 103, 511, 1956), with parameters I = 270 eV and T_0 + 2 keV (I -- ionization potential, T_0 -- cutoff energy). "The authors thank Professor V. I. Veksler and S. I. Lyubomilov for collaboration in the irradiation of the emulsions at OIYaI, and Professor W. O. Lock for supplying the emulsions irradiated at CERN, as well

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L 22175-65

ACCESSION NR: AP5001824

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as G. B. Zhdanov and M. I. Tret'yakova of FIAN for a discussion on this question." Orig. art. has: 2 figures.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics, Academy of Sciences Kazakh SSR)

SUBMITTED: 12May64 ENCL: 00

SUB CODE: NP NR REF SOV: 006 OTHER: 003

Card 3/3